Identifying Nontechnical Skills Associated With Safety in the Emergency Department: A Scoping Review of the Literature

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Study objective: Understanding the nontechnical skills specifically applicable to the emergency department (ED) is essential to facilitate training and more broadly consider interventions to reduce error. The aim of this scoping review is to first identify and then explore in depth the nontechnical skills linked to safety in the ED.

Methods: The review was conducted in 2 stages. In stage 1, online databases were searched for published empirical studies linking nontechnical skills to safety and performance in the ED. Articles were analyzed to identify key ED nontechnical skills. In stage 2, these key skills were used to generate additional key words, which enabled a second search of the literature to be undertaken and expand on the evidence available for review.

Results: In stage 1, 11 articles were retrieved for data analysis and 9 core emergency medicine nontechnical skills were identified. These were communicating, managing workload, anticipating, situational awareness, supervising and providing feedback, leadership, maintaining standards, using assertiveness, and decisionmaking. In stage 2, a secondary search, using these 9 skills and related terms, uncovered a further 21 relevant articles. Therefore, 32 articles were used to describe the main nontechnical skills linked to safety in the ED.

Conclusion: This article highlights the challenges of reviewing a topic for which the terms are not clearly defined in the literature. A novel methodological approach is described that provides a structured and transparent process for reviewing the literature in emerging areas of interest. A series of literature reviews focusing on individual nontechnical skills will provide a clearer understanding of how the skills identified contribute to safety in the ED. [Ann Emerg Med. 2012;59:386-394.]

INTRODUCTION
Background and Importance

During recent years, there has been increasing recognition that clinicians must possess excellent clinical skills and be proficient in an array of “nontechnical skills” for optimum patient care. Nontechnical skills are defined as “the cognitive, social and personal resource skills that complement technical skills, and contribute to safe and efficient task performance.”1 This includes communication and leadership, for example. Although debate surrounds use of the phrase nontechnical skills and its potential to devalue a critical aspect of clinical practice,2 it is now in common usage and is a term that is widely recognized and understood.

Nontechnical skills are closely related to teamwork; however, there appears to be some confusion over the use of these terms and they are often undefined and used ambiguously.3 Although nontechnical skills, by definition, contribute to safe and efficient performance, team skills are those necessary for effective team functioning.4 For example, although decisionmaking should ideally use team input to ensure patient safety, this skill does not necessarily contribute to effective team functioning. Whereas these definitions may appear straightforward, in practice the terms are often used interchangeably. The MedTeams project examined teamwork skills related to patient safety in the emergency department (ED),5 yet many of the “teamwork actions” listed are more closely related to nontechnical skills than teamwork skills.

Experienced clinicians have demonstrated adept nontechnical skills as an integral part of their expertise6; however, acquisition of skills has generally been ad hoc and unsystematic. Although most emergency physicians agree that non-technical skills are an important element of safe and efficient performance, it is not clear exactly which skills are most relevant in the ED or how these skills manifest in clinical practice. Historically, focus on nontechnical skills in the ED has relied on principles borrowed from the aviation industry or anesthetics. Though many nontechnical skills are widely applicable both within and outside of medicine, emergency
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medicine provides some distinctive challenges. For example, emergency physicians routinely have to deal with high levels of interruptions and multitasking in ways that surgeons, anesthetists, and pilots do not. It is essential that clinicians and researchers understand exactly which nontechnical skills are specifically applicable to the unique working environment of the ED. Furthermore, it is necessary to describe how these skills play out in clinical practice within the ED. This will facilitate specific training and assessment of skills and will allow broader consideration of practical interventions to reduce error in the ED.

There have been several literature reviews examining teamwork and nontechnical skills related to emergency medicine. However, these reviews have centered on resuscitation team performance, staff attitudes, and evaluation of simulation training rather than attempting to demonstrate a link between safety and specific behaviors exhibited by emergency staff. To our knowledge, there is currently no review of the literature that explicitly lists the nontechnical skills associated with safety in the ED. It is also essential to consider the skills necessary for all aspects of emergency medicine work rather than focus on critically ill or injured patients in the resuscitation room.

The definition and training of nontechnical skills is comparatively new to emergency medicine, so studies are relatively few and use diverse research methodologies. Therefore, a scoping review was carried out in preference to a systematic review of the literature. Systematic reviews are narrow in focus and are guided by specific research questions, in which the aim is to be comprehensive in identifying all sources within the inclusion criteria. In contrast, scoping reviews are comprehensive in describing the range and nature of existing evidence and form part of the preliminary investigative process, which can then guide more focused lines of research.

Goal of This Investigation

The aim of this scoping review was to identify and then explore in detail the nontechnical skills specifically linked to safety and error in the ED.

MATERIALS AND METHODS

This review was conducted in 2 stages. Stage 1 involved a search of the literature to produce a list of nontechnical skills related to safety in the ED. Stage 2 used this list of individual skills to guide a further search of the literature and expand the evidence for review. This method was chosen because preliminary searches of the literature identified very few articles focusing specifically on nontechnical skills and safety in the ED. Relevant studies were missed because they either focused on isolated skills, such as communication, or reported a range of skills but failed to use the general terms “nontechnical skills” or “teamwork.” Therefore, to complete an adequate review of the literature, first it was necessary to identify important skills.

During stage 1, a series of databases was searched, including MEDLINE, EMBASE, and PsychINFO (covering behavioral sciences in medicine, law, and other fields). This was supplemented by searching Health Information Resources (a service open to National Health Service staff to enable simultaneous access to a number of databases) and reviewing reference lists of seminal articles and relevant systematic reviews. Key words and Medical Subject Headings terms were generated around 3 main concepts as dictated by the research question, namely, emergency medicine, nontechnical skills, and error. The search terms were

- Concept 1: “Nontechnical” or “team work” or “human factor” or “leadership” (and all variations)
- Concept 2: “Emergency medicine” or “emergency department” or “accident and emergency” or “emergency physician” or “resuscitation” or “trauma team” or “arrest team” (and all variations)
- Concept 3: “Error” or “safety” or “critical incident” or “adverse event” (and all variations)

Results from the 3 searches were combined and limited to abstracts and titles of articles published between 1988 and November 2010, using human subjects, with abstracts available. The search strategy was agreed on by members of the research team, comprising 2 emergency physicians and 2 human factors experts. Sensitivity of the search was checked by ensuring that known relevant articles were retrieved by the search, and key words were modified or added accordingly.

All articles retrieved by the search were assessed by 2 emergency medicine clinicians (L.F. and R.B.) and consensus was reached after discussion. These were assessed according to the following inclusion and exclusion criteria:

- Inclusion criteria:
  - Empirical study, eg, observational, case note analysis, interview or survey
  - Adult or pediatric emergency medicine
  - The main focus of the article related to identifying nontechnical skills related to error or safety in the ED or where nontechnical skills were identified as a significant contributory factor

- Exclusion criteria:
  - Related to specific types of error, eg, incorrect radiologic or ECG interpretation
  - Out-of-hospital care or neonatal resuscitation
  - Review of the literature or commentary (although reference lists were checked)

Of 98 articles identified through the search, 22 abstracts were potentially relevant. Full-text copies of the articles were sought and screened according to the selection criteria. Fifteen articles fulfilled the inclusion criteria, but 6 were excluded because they were precursor or follow-on studies of other articles that were already included for review (ie, a single research project had been published in more than 1 article). A further 7 articles did not fulfill the inclusion criteria, so 13 articles in total were excluded. Two additional articles were
found by manual searching of reference lists. Searches with Health Information Resources did not reveal any new relevant articles. A total of 11 articles were used for data extraction.

Data on study design, country of origin, and sample were recorded. A grounded theory approach was used to enable categorization of skills. This method uses codes derived from the data rather than relying on a predefined theoretical coding framework. The process involved a single researcher (L.F.) reviewing all articles and noting any behaviors or skills mentioned by authors as contributing to safety or efficiency in the ED. Through discussion within the research team, these factors were then grouped together to identify skill categories.

During stage 2, skills identified from analysis of articles extracted during the stage 1 review were used to generate new key words. These terms were used to expand concept 1 for use in a secondary search. Search terms included the main skill headings identified in stage 1 plus alternative terms commonly used by authors of reviewed articles. For example, articles that provided data coded into the skill assertiveness also frequently included the terms “hierarchy” and “authority gradients” within the text. The choice of terms was decided pragmatically, and some terms were later excluded because the search retrieved too many irrelevant articles. For example, the term monitor appeared in articles related to situational awareness, but searches produced excessive numbers of articles related to monitoring devices.

The final list of search terms used to expand concept 1 was “communication,” “handover,” “handoff,” “workload,” “interruption,” “anticipate,” “plan,” “brief,” “situational awareness,” “supervision,” “feedback,” “standards,” “authority,” “assert,” “hierarchy,” “decision-making,” “and all variations. These terms were searched with MEDLINE, EMBASE, and PsychINFO databases, and relevant articles were identified by using the same inclusion and exclusion criteria described for stage 1. The secondary search identified an additional 713 articles, 21 of which fulfilled the inclusion criteria.

RESULTS

The 11 articles identified during stage 1 of the review are indicated in the Table. A total of 34 skills and behaviors were identified in the articles, and these were condensed into 9 broad skills. For example, patient monitoring, system monitoring, team cognition, patient supervision, maintain situational awareness, and shared mental models were all classified under the skill heading “situational awareness.” The factors identified as being associated with safety and error in the ED are shown in the Figure.

For stage 2, a total of 32 articles were used to describe the main nontechnical skills related to safety in the ED, and the Table summarizes the data extracted.

Twenty articles commented on the association between communication and error in the ED. One research team interviewed ED staff at 3 to 4 hourly intervals during a shift and found that 12% of errors involved miscommunication. An Australian team monitored critical incidents and then asked staff to make suggestions on the reporting form. Improved communication was identified as the most important corrective strategy in 21% of incidents.

Numerous studies have identified team transition at shift changeover or transfer of information between providers as a source of error in the ED. One research team specifically commented on how different expectations between ED and inpatient teams had a negative influence on information flow. A case study highlighted how transition between multiple care providers can perpetuate a failure to diagnose the underlying medical illness. The authors described how this transition may cause communication breakdown because of insufficient or inaccurate data, mistimed or delayed information, poorly organized data, and the insertion of “pseudoinformation.” A year-long observational study in 2 EDs identified 4 communication events in a patient’s journey that were linked to potential adverse outcomes: during triage, ambulance transfer, ED handover, and admission. The observers also noted that barriers to effective communication included (1) hierarchy, in which nurses and junior physicians were reluctant to question senior colleagues; (2) noise in the department; and (3) the absence of somewhere to speak in private.

The potential for closed-loop communication to enhance information exchange and reduce error was identified in 3 studies. This type of communication, in which the message is repeated to ensure correct transmission, could potentially reduce errors caused by “slips” (errors in the performance of skill-based behaviors that occur when our attention is diverted).

Workload management is a complex skill that covers a wide range of behaviors. The review identified a number of aspects of workload management related to safety and error, including assigning roles, dealing with interruptions, prioritizing tasks for individual patients and triaging patients, practicing backup behavior, allocating tasks and coordinating team activities, and cross-monitoring actions of team members to manage workload. These elements clearly overlap with other
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nontechnical skills because dealing with interruptions involves effective communication and assertiveness, and cross-monitoring actions requires adequate situational awareness. A study using both observations and interviews to explore why trainees may be reluctant to ask for help concluded that one of the main barriers was heavy workload, and a study examining diagnostic errors in the ED identified excessive workload as a contributing factor in 23% of cases. Another study involving observations and interviews concluded that intense workload and excessive interruptions reduced emergency physicians' ability to attend to safety and error.

The skill anticipating refers to the planning and briefing that is often associated with the expected arrival of a critical patient. Preparations may include allocating team roles, identifying available equipment, or noting ED capacity. However, this skill also refers to the ability to consider a patient's potential future course and therefore react efficiently to any deterioration in condition. This may include, for example, transferring an unstable patient with resuscitation and intubation equipment. Anticipation is also important for considering the disposition of a patient. One study commented on significant delays involving consultation from specialty teams and transfers to the ICU. A focus group study identified anticipation as one of the main ways ED nurses identified and subsequently interrupted and corrected medical errors.

Situational awareness involves surveying the environment to pick up cues that may need action, requesting updates from others, and relaying information to the team. The studies included in this review described a number of elements that are essential for good situational awareness in the ED. These include adequate patient monitoring and observation, system monitoring (tracking team resources and environmental conditions), team cognition and shared mental models (ie, sharing information so that each team member has a similar understanding of task requirements and role responsibilities), and monitoring execution of plans. Surveillance is also important for identifying and averting medical hazards.

The importance of supervision in the ED has been highlighted in a number of studies. Supervision failure has been implicated in up to a third of adverse events and a third of closed malpractice claims in the United States. A study of closed claims in the Netherlands found that resident supervision by a consultant was documented in only 15% of medical records, and the authors commented on the need for improved supervision of junior physicians. A critical incident (interview) study based in the United Kingdom identified 4 key situations in which supervision is required: performance of a key practical skill, arrival at a key diagnosis, the performance of a key management step, and support in dealing with a complex referral.

Many clinicians are aware that lack of feedback in the ED is a particular concern. Feedback is not only important from within the ED team, it is also vital that ED staff inquire about patient outcome from admitting teams or records to enhance...
the learning process. A US-based research team interviewed medical, surgical, and obstetric residents (not emergency medicine residents) about errors involving ED care and found that the majority of errors were not discussed with the ED team.41 Other articles reviewed identified the need for debriefing after critical cases as a method of feedback.28,42 In particular, a group at the Emergency Medicine Consensus conference specified that debriefing should involve discussion of team processes, as well as errors and “near misses,” rather than focusing on performance and outcome.28

There is a great deal of evidence, both within and outside medicine, that points to the importance of effective leadership, and this is reflected in the fact that 7 articles linked leadership skills with safety and error in the ED.28,29,31,36,37,42,43 In particular, the need for a clearly identifiable leader is highlighted.29,37,42,43 A UK research team using failure mode and effects analysis to identify hazards in resuscitation categorized “a lack of designated leader” as both highly probable and a severe risk of harm to the patient.43 One interview study also commented on the conflicting demands put on resuscitation team leaders.29 The commonly accepted principle that the leader should maintain a hands-off approach is challenged in situations in which the leader is considered the most competent in solving technical problems.

Maintenance of standards includes adhering to accepted codes of good practice and following established treatment protocols or guidelines. For example, standards may relate to washing hands before examining a patient or following safety protocols during procedural sedation. Three articles included in this review noted the importance of maintaining standards and following protocols for ensuring patient safety.29,37,39 Studies mainly focused on teams in the resuscitation room.29,37, however, adhering to procedures is clearly important for any intervention or management plan. Difficulties may arise in determining whether any deviation from protocol is the result of knowledge gaps or errors in execution. Furthermore, deviations may be an appropriate response to conditions not anticipated in the protocol, sometimes referred to as “necessary violations.” There is also overlap with other skills because failure to maintain standards may reflect work overload or cognitive errors of decisionmaking. Failing standards covers other practices such as poor documentation, which was found to be a contributing factor in 20% of closed malpractice cases.39

Skillful use of authority and assertiveness is essential for emergency medicine clinicians. This review identified several circumstances in which error may occur, including failure to assert a position or corrective action,5,29,42 inadequate conflict resolution,24,31,42 and rigid authority gradients.14,15,21,22

Researchers in an observational study witnessed the effect of junior staff who felt unable to question senior staff.22 A 30-month observational study investigating error in the ED identified the importance of authority derived from experience, unique access to information, or being at hand in an emergency, in addition to authority from formal status.14

Decisionmaking is a fundamental skill for emergency physicians. The Netherlands’s closed claims review found 48% of cases were due to “failure to diagnose properly,”60 and an interview study in the United States found that 8 of the 16 cases discussed involved misdiagnosis.41 This was contrasted with nursing staff reports that mainly involved errors in delivery of care. A UK study investigating critical incidents identified cognitive errors as one of 3 primary latent conditions.14 Cognitive errors include slips and mistakes, cognitive bias (such as confirmation bias, looking for confirming evidence to support a hypothesis rather than to refute it), and errors of interpretation. A case study highlighted a multitude of ways diagnostic error may occur, including failure to consider an alternative diagnosis, error caused by inheriting someone else’s thinking, errors of prevalence estimation, and affective errors.21 A review of 4 major clinical incidents in an Italian ED highlighted how overreliance on the use of patterns during cognitive processes may cause errors.44 Staff in the ED are particularly prone to cognitive error, in part because of the high frequency of interruptions and the need to multitask.8 This review identifies the importance of team input in decision making as a key strategy to reduce error in the ED.5,29,42

LIMITATIONS

This review shows that searching for relevant articles is difficult because there is no standardized use of terms. Although the secondary search could have been further expanded to incorporate other key words, it was limited for pragmatic reasons. Furthermore, the purpose of this scoping review was to give an initial overview of the literature available and provide a guide for future detailed research on individual skills.

The evidence presented in this review is qualitative rather than quantitative, ie, interviews, questionnaires, and observational research. With the recommended the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system45 for assessing the quality of evidence (high, moderate, low, very low), all the articles identified would be rated low or very low. However, qualitative research is useful for identifying and defining the “problem” which can then be further explored quantitatively. Although it is impossible to quantitatively determine the effect of skills such as anticipation, it is possible to quantitatively assess the effect of nontechnical skills training on error reduction. This has been attempted with limited success, with most studies demonstrating only improved team performance or positive effects on staff attitude.36-49

DISCUSSION

For the first time, to our knowledge, this review draws together a clear evidence base to identify key nontechnical skills for safe practice in the ED. Some skills, such as communication and situational awareness, already have well-established links to safety in medicine. However, this review highlights other skills that may be less obvious but are highly relevant and specific to
emergency medicine staff. For example, maintaining adequate supervision was identified as a key skill in the ED. Crew resource management is a form of nontechnical skills training that originated in the aviation industry and has been widely applied in emergency medicine. Crew resource management principles emphasize the importance of peer monitoring, but this review goes farther to explore the particular risks related to junior staff. In aviation, junior pilots remain in close proximity to the captain throughout the flight, allowing continuous supervision. Similarly, senior surgeons work directly alongside more junior surgeons when supervising in the operating room. In contrast, many EDs operate with inexperienced trainees working relatively autonomously and with only intermittent supervision. Emergency physicians need to develop skill in providing adequate and efficient supervision, tailored to specific circumstances and individuals.

This review of the literature also gives added detail to those skills widely recognized as important but often only vaguely understood in practice. For example, root-cause analysis often concludes that improved communication is necessary to avert future incidents, but this may be hard to translate into practice. The articles related to communication in this review identify the riskiest phases of the patients’ journey in the ED (eg, handoff), describe what constitutes poor communication (eg, insertion of pseudoinformation), note barriers to effective communication (eg, noise), and suggest how information exchange may be enhanced (eg, closed-loop communication). Similarly, workload management is divided into 6 key behaviors that can be directly applied to daily clinical work to improve safety in the ED: assigning roles, dealing with interruptions, prioritizing tasks for individual patients and triaging patients, practicing backup behavior, allocating tasks and coordinating team activities, and cross-monitoring actions of team members to manage workload.

Some may argue that not all the skills identified in this review are indeed skills because, by definition, a skill is an ability or capacity that is acquired or developed through training or experience. For example, a commonly held belief is that one is either born to lead or one is not. Our approach was to consider skill in the broadest context. Although some people may be more naturally assertive, there is also a range of behaviors (with the underlying rationale) that can be taught to help improve one’s assertiveness. Similarly, good documentation forms part of “maintaining standards.” The elements that make up good documentation can be taught, and, perhaps more important, motivation to provide clear, legible documentation can be given by educating staff on the link to patient safety. It is anticipated that through identification and description of these main skills, the constituent behaviors can be taught through training programs and specific, individual feedback.

The implications of this review are far reaching in terms of education and training, as well as clinical application. Although a number of tools have been developed for assessing nontechnical skills in the resuscitation room, as yet there is no tool that encompasses all aspects of ED work. Identifying the core emergency medicine nontechnical skills in this literature review will provide an important first step to creating such a tool. Rather than borrowing from principles derived in other fields, such as aviation and anesthesia, this review enables the development of tailor-made training programs focusing on skills described specifically for emergency medicine. The identification of key nontechnical skills for emergency physicians may also have implications for the selection of trainees. Again following the lead of the aviation industry, other specialties have considered broadening candidate selection criteria to include relevant nontechnical skills, such as problem solving and communication. Finally, this review of the literature helps identify and focus opportunities for safety interventions, such as developing cognitive aids to assist decisionmaking or introducing structured handover pro forma.

This review highlights the challenges of reviewing a topic in which the language is not yet established in clinical practice and the terms are not clearly defined in the literature. However, a 2-stage approach using an initial search to identify key words to inform a second, more detailed search overcame this difficulty. This novel methodological approach provides a structured and transparent process for undertaking a review of the literature in emerging areas of interest.

The strengths and weaknesses of scoping reviews are evident. Scoping reviews can be used to address broader topics than the limited confines of a systematic review. This provides a rigorous method for summarizing evidence that may have previously been considered too disparate or indistinct for traditional reviews. However, scoping reviews do not typically appraise the quality of studies, so there is less opportunity to synthesize data to definitively answer a research question. Furthermore, scoping reviews tend to include studies using a wide range of methodologies, and as yet there is no accepted method for synthesizing and interpreting data.

The aim of this article is to give an overview of the literature available, drawing specifically on empirical evidence related to safety. There are likely to be other articles that usefully describe emergency medicine nontechnical skills; for example, those that focus on team performance but are unable to demonstrate a direct association between specific behaviors and safety. Now that the principal skills have been identified, further literature reviews should be undertaken to gain a deeper understanding of the elements required for each skill.

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**REFERENCES**


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